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drawings are of bud, leaf-scar, pith, and other twig characters upon which the keys are based, so that with the use of a hand lens it should be possible to determine readily the genera, and for the most part the species, for native and introduced trees and shrubs. The author is to be congratulated in making such a fund of unusual information available in such a compact and readily available form.—GEO. D. FULLER.

**American trees.**—Another book on trees, by EMERSON and WEED,<sup>5</sup> has been added to the already large number upon the same subject. It is essentially a book for the amateur, since its chief virtue lies in the excellent photographs by EMERSON, an entire page being devoted to each species. The absence of keys of any sort renders the book comparatively useless for the identification of an unknown species, but the quality and abundance of the illustrations will make it one the tree lover will wish to have upon his table.—GEO. D. FULLER.

#### NOTES FOR STUDENTS

**Physiological balance in soil and other nutrient solutions.**—HIBBARD<sup>6</sup> has just published a piece of work on physiological balance in soil solution which is to mark a decided advance (both theoretically and practically), if the future development of the work approximates its present promise. He extracted the soil solution from an infertile very sandy soil and from a fertile sandy loam by the Van Soest oil pressure method as improved and extended in usefulness by MORGAN.<sup>7</sup> HIBBARD speaks of this as giving a more concentrated solution than any other extraction method. The solution thus extracted from the poor sandy soil had an osmotic pressure of 0.193 atmospheres, and that from the good soil 1.81 atmospheres. The soil extracts showed an order of production similar to the soils from which they came.

The soil extracts were used instead of distilled water to prepare the Shive 3-salt ( $\text{KH}_2\text{PO}_4$ ,  $\text{Ca}(\text{NO}_3)_2$ ,  $\text{MgSO}_4$ ) nutrient solution. The total concentration of nutrient salts added gave an osmotic pressure of 1.75 atmospheres, and in the 36 different solutions made up from each soil extract and from distilled water the proportions of each salt varied from 10 to 80 per cent of the total nutrient salt osmotic concentration.

In the nutrient solution made from the extract of the poor soil the optimum osmotic proportions of the  $\text{KH}_2\text{PO}_4$ ,  $\text{Ca}(\text{NO}_3)_2$ , and  $\text{MgSO}_4$  for the growth of Fultz wheat were 7:1:2 respectively, with a total osmotic pressure of (1.75+0.193) 1.94 atmospheres; in that made from the extract of the good soil 2:7:1 respectively, with a total osmotic pressure of (1.75+1.81) 3.56 atmospheres; and in that made with distilled water 5:2:3, with a total osmotic pressure of

<sup>5</sup>EMERSON, ARTHUR I., and WEED, C. M., *Our trees, how to know them*. New ed. pp. xxi+295. *pls.* 149. Philadelphia: Lippincott Co. \$3.50.

<sup>6</sup>HIBBARD, R. P., *Physiological balance in the soil solution*. Tech. Bull. Mich. Agric. Exper. Sta. no. 40. pp. 44. 1917.

<sup>7</sup>Tech. Bull. Mich. Agric. Coll. Exp. Sta. no. 28.